

PROCEEDINGS  
OF THE  
BIOLOGICAL SOCIETY OF WASHINGTON

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STUDIES OF NEOTROPICAL CADDISFLIES,  
XVI: THE GENUS *AUSTROTINODES*  
(TRICHOPTERA: PSYCHOMYIIDAE)

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The family Psychomyiidae (sensu Ross 1944) is represented in the Chilean subregion by two genera, *Polycentropus* and *Austrotinodes*. The former, because of its nearly worldwide distribution and diversity of species, must be analyzed in detail before the zoogeographical relationships of its various units can be understood. *Austrotinodes*, however, has heretofore seemed to be a perfect example of a Gondwanaland relict. It has been known only from the west of the Andes and south of Central Chile, and is most closely related to a genus occurring in Australia and New Zealand. This type of distribution pattern has been found in other rheophilous, cold-stenothermal aquatic insects (Brundin, 1966; Edmunds, 1972; Illies, 1965) and has been postulated to be the result of the disruption of an old continuous distribution by continental drift.

Recent field work (supported in part by NSF grant GB-2616 and the U.S. Antarctic Research Program) has produced several valuable collections of *Austrotinodes*. As a result the known distribution is now extended into northern South America, Central America, and Mexico; good evidence as to the subfamily placement of the genus is provided by the previously unknown larvae and pupae; and additional examples of Chilean species have served to fill in details of the distribution of these species. Unfortunately it is still not possible to present a complete analysis of this genus, primarily because the immature stages of related genera are unknown.

I am indebted to Mr. George Venable, staff artist of the Department of Entomology, Smithsonian Institution, for the excellent habitus view of the larva and phylogenetic diagram. Mr. M. E. Irwin and Dr. Saul Frommer of the Department of Entomology, University of California, Riverside (UCR) lent important Neotropical collections.

Genus *Austrotinodes* Schmid

Type-species: *Austrotinodes latior* Schmid (original designation).  
*Austrotinodes* Schmid, 1955:132; 1958:200.—Kimmins, 1957:260.—  
 Fischer, 1972:87.

*Adult*: Length of forewing, 6–8 mm. Spurs, 3,4,4. Forewing with  $R_1$  forked apically,  $R_{2+3}$  unbranched;  $R_{4+5}$ ,  $M_{1+2}$ ,  $M_{3+4}$ , and  $Cu_1$  all branched. Hindwing lacking corneous point in fork of  $R_{4+5}$ ;  $R_{4+5}$ ,  $M_{1+2}$ , and  $Cu_1$  all branched; discoidal cell present or absent. Male genitalia: Ninth segment deeply divided laterally. Cerci large, often elongate, usually with mesal teeth and a basomesal process. Tenth tergum apparently a simple mesal lobe. Claspers usually fused mesally, generally with a mesal rodlike process basodorsally. Aedeagus basically tubular, often with lateral processes.

*Larva*: Length to 11 mm, width 1 mm. Head, pronotum, and forelegs chestnut brown; meso- and metanota, and mid and hindlegs yellowish; abdomen whitish, dorsally with purplish flecks (Fig. 1).

Head considerably elongate, broadest posteriad; with a ventro-lateral carina from eyes posteriad; with only primary setae (Fig. 2). Frontoclypeus with anterior margin rounded, elongate and parallel-sided. Labrum sclerotized, without secondary setae or brushes; inner surface asymmetrically sclerotized with a row of basally directed spinelike setae (Fig. 8). Mandibles long and slender; without mesal brushes; with dorsal cutting edge overhanging ventral edge, left mandible deeply concave between cutting edges (Figs. 5, 6). Maxillae without secondary setae or brushes; palpifer and galea elongate; palpus with basal two segments very short, third greatly elongate, fourth about half length of third; labium with an elongate mesal lobe, palpus long and slender (Fig. 4).

Pronotum with few secondary setae; posterolateral angle greatly developed and meeting at midventral line. Propleuron fused to trochantin which is elongate and narrow in lateral aspect but rather broad in dorsal. Foreleg heavily sclerotized; coxa elongate, broad, apically with a stout black seta (Fig. 9). Meso- and metanota sclerotized, divided longitudinally on midline with few secondary setae (Fig. 3). Mid and hindlegs more lightly sclerotized than foreleg; coxae normal (Fig. 10). Hindleg with scattered setae on trochanter, femur, tibia, and tarsus modified into short, enlarged spines; claw slender and straight (Fig. 11).

Abdomen without lateral line setae; with only scattered primary setae. Anal proleg with basal membranous section lacking setae; sclerite with

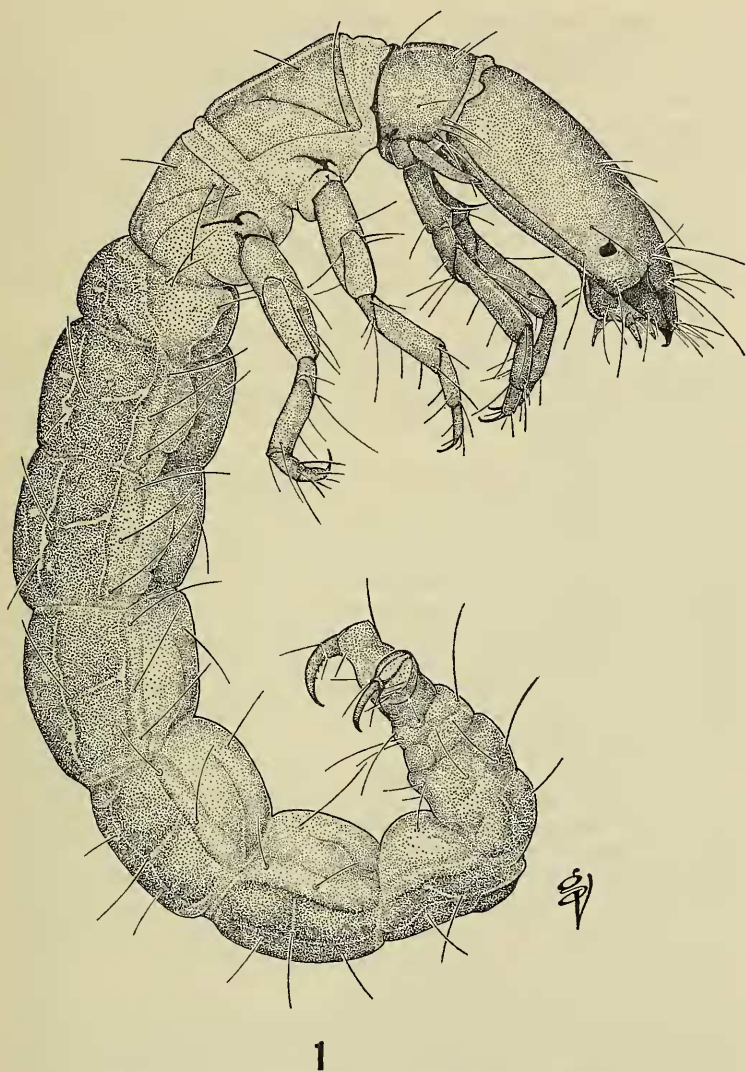


FIG. 1. *Austrotinodes* sp: larval habitus view.

a few setae. Claw evenly curved and tapered; ventral margin with a few small teeth at midlength (Fig. 7).

*Pupa:* Length to 7 mm. Mandibles elongate, curved, mesal margin without serrations (Fig. 13). Labrum roughly semicircular, with a distinct basal section; a cluster of setae basolaterally on apical portion,

three elongate setae laterally on each side of basal section (Fig. 12). Front with two pairs of setae mesally and a small seta near eye ventrally; with tentorial pits mesad of eye large and deep. Basal antennal segment with two stout setae; antennae barely surpassing tip of abdomen. Tarsus of metathoracic leg with a fringe of hairs. Wing pads reaching fifth abdominal segment. Hook plates anteriorly on segments 2-8, posteriorly on 5 (Fig. 15). No lateral line fringe of hairs; with one to three stout setae posterolaterally on each segment. Each segment dorsally near posterior margin with four pairs of setae which become progressively larger toward the eighth segment; each segment ventrally with three pairs of setae. Apical process a small lobe bearing a cluster of long setae (Fig. 14).

The description of the larva is based on a series taken in Chile, Prov. Llanquihue, 10 km north of Pargua, 5 June 1969, P. & P. Spangler. These larvae show no differences from the sclerites associated with a male metamorphotype of *A. recta* Schm., which is the basis for the description of the pupa.

The adults and larvae clearly substantiate the placement of *Austrotinodes* in the subfamily Ecnomiinae (as defined by Kimmins, 1957), whereas the relationship evinced by the pupae is less clearcut. The Ecnomiinae are composed of the genera *Ecnomus* McLachlan (Palearctic, Ethiopian, Oriental, and Australian Regions), *Parecnomina* Kimmins (Ethiopian Region), *Psychomyiellodes* Mosely (Ethiopian Region), *Ecnomina* (Australian Region), and *Austrotinodes* Schmid (Neotropical Region). The genus *Ecnomodellina* Ulmer (*Ecomodes* Ulmer) described from Ecuador and originally placed in the Ecnomiinae is a synonym of *Polyplectropus* Ulmer (Flint, 1968) and as such must be removed to the Polycentropodinae.

The evolutionary history (Diagram 1) of the Ecnomiinae seems to proceed from an ancestral form that possessed a rather complete venation ( $M_1$  and  $M_2$  present in the hindwing,  $R_2$  and  $R_3$  present in the forewing), and a comparatively unmodified genitalia (the claspers separate, and only one pair of processes from both the cerci and aedeagus). This ancestral form must have been found over much of Gondwanaland early in the Cretaceous. The line that remained with the African fragment retained most of these ancestral characteristics, whereas the line that developed in the Australian-New Zealand-Chilean fragment became specialized by the fusion mesally of the claspers, development of additional processes from the cerci and aedeagus, and complete fusion of  $R_2$  and  $R_3$  in the forewing. Of all living genera, *Parecnomina* is probably most like the ancestral form. *Ecnomus*, which is easily derived by the fusion of  $M_1$  and  $M_2$  in the hindwing, is the most successful of living genera, with many species scattered over Africa, Europe, southern Asia, and Australia. The genus *Psychomyiellodes* is the most specialized in this line, having a specialized spur on the male tibia, a cuplike structure laterally on the male genitalia, and a fusion of  $R_2$  and  $R_3$  in the forewing in some species.

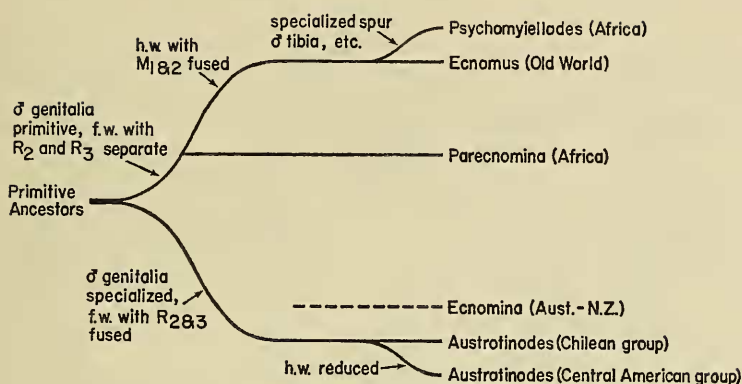


DIAGRAM 1. Phylogenetic tree of the subfamily Ecnomiinae.

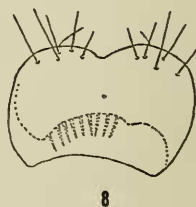
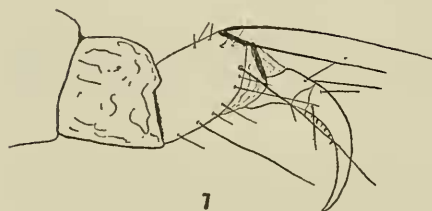
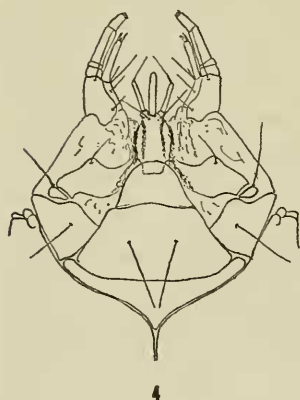
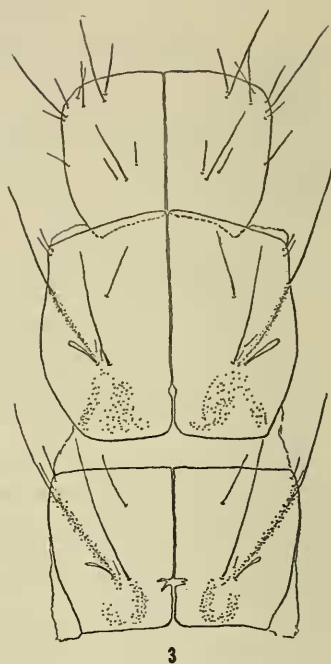
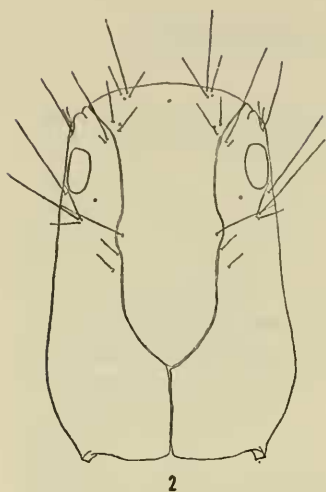
The second evolutionary line consists only of the genera *Ecnomina* and *Austrotinodes*. The descriptions of the genitalia and ventation of *Ecnomina* offer no ready means to distinguish this genus from *Austrotinodes*, and the two genera may ultimately be synonymized. However, until better descriptions of *Ecnomina* are published and its immature stages become known, it seems better to retain separate genera for the Australian-New Zealand and South American components. Within the genus *Austrotinodes*, the Central American-northern South American group of species appears to be the most specialized. In these species the hindwing is reduced in size with the consequence that one anal vein is lost and the area occupied by the radial veins is smaller.

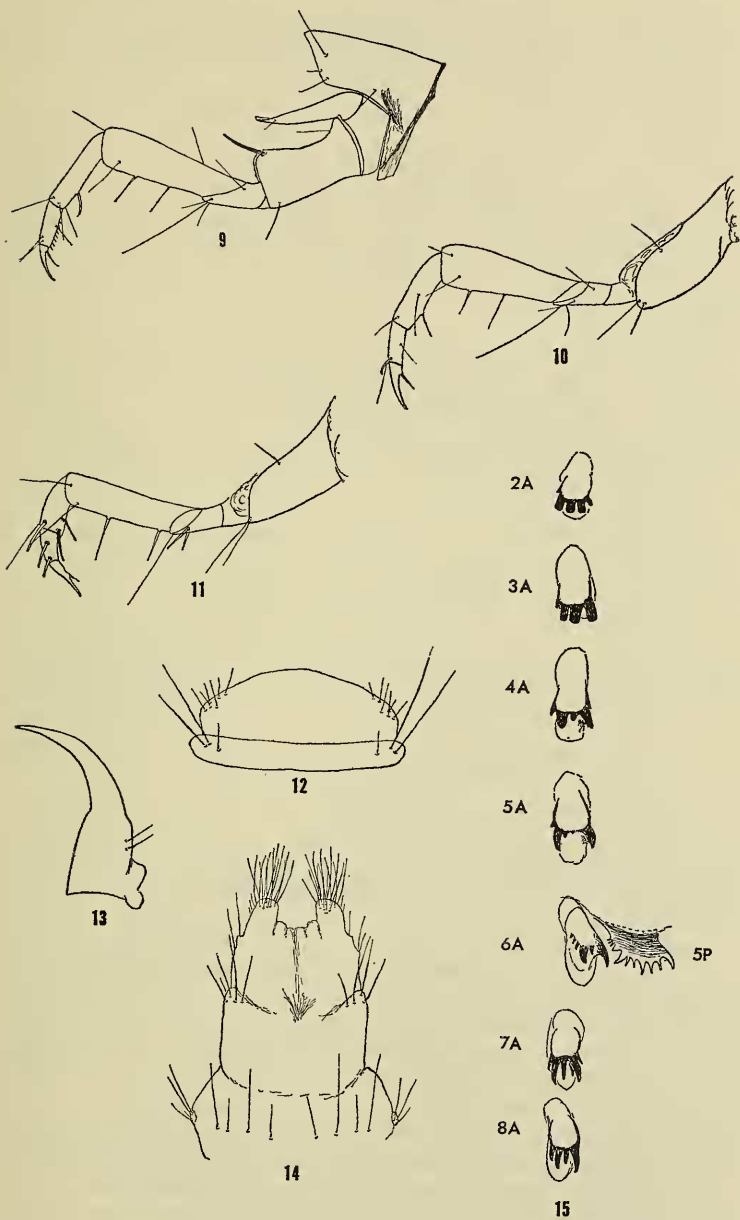
The larvae of *Austrotinodes* agree with the larvae of *Ecnomus* (the only other genus in the subfamily in which the immature stages are known) in the following characteristics: mandibles without a mesal brush, labial palpi elongate, maxillary palpi with first two segments short and the third very long, and all thoracic nota sclerotized. It differs from *Ecnomus* in the shape of the head, structure and chaetotaxy of the legs, and lack of lateral line.

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FIGS. 2-8. *Austrotinodes* sp.: 2, larval head, dorsal; 3, larval thoracic nota, dorsal; 4, larval maxillolabium, ventral; 5, larval right mandible, ventral; 6, larval left mandible, ventral; 7, larval anal proleg, lateral; 8, larval labrum, dorsal.

FIGS. 9-15. *Austrotinodes* sp.: 9, larval foreleg and prothorax, lateral; 10, larval midleg, lateral; 11, larval hindleg, lateral. *A. recta* Schm.: 12, pupal labrum, dorsal; 13, pupal mandible, dorsal; 14, apex of pupal abdomen, dorsal; 15, pupal hook plates, dorsal (A = anterior, P = posterior, 1-8 = segment number).





The pupae of *Austrotinodes* and *Ecnomus* have mandibles of roughly similar shape, and the apical appendages are also very similar. However, the chaetotaxy of the labrum, number and form of the hook plates, and chaetotaxy of the abdomen are very different.

I have not collected active larvae of *Austrotinodes*, only prepupae and pupae. These latter were in elongate, rather flimsy shelters of sand and silk on the underside of rocks in riffles of small and medium sized streams. The ecological data associated with the one collection of larvae indicates only that they were picked off rocks in a sandy, rocky stream. Because of the odd structure of the legs and rather hairless appearance of the larva, I am suspicious that they may be tube-dwellers, possibly in the sand or gravel of the stream bottom or on rocks and large boulders.

The following key will separate the adult males of *Austrotinodes*. The species *A. lineata* (Navas) and *A. talcana* (Navas) are known from females only and are presently unidentifiable.

1. Clasper three to four times longer than broad in both lateral and ventral aspects ..... 2  
     Clasper not more than barely twice as long as broad in lateral aspect, and as broad as or broader than long in ventral aspect ..... 5
2. Clasper in lateral and ventral aspects with a distinct subapical lobe or angle laterally ..... 3  
     Clasper without an apicolateral lobe in either lateral or ventral aspect ..... 4
3. Cercus broadly triangular, with basoventral process short and triangular in lateral aspect ..... *triangularis*  
     Cercus narrow and elongate, with two pairs of elongate basoventral processes ..... *irwini*
4. Claspers in ventral aspect divided mesally and ending in two dark points ..... *quadrispinosa*  
     Claspers completely united mesally, apex a narrow rectangular lobe, blackened laterally ..... *recta*
5. Clasper in lateral aspect with distinct basodorsal and apicomesal lobes ..... 6  
     Clasper in lateral aspect a simple, rounded structure ..... 7
6. Claspers in ventral aspect with fused mesal region narrowly and distinctly produced apicad ..... *cekalovici*  
     Claspers in ventral aspect with fused mesal region only broadly and slightly produced apicad ..... *mexicanus*
7. Mesal process between claspers forked apically ..... *latior*  
     Mesal process not forked ..... 8
8. Basoventral process of cercus ending in a point or a single spine 10  
     Basoventral process of cercus ending in a cluster of spines ..... 9
9. Basoventral process of cercus much enlarged apically, and with a distinct apicomesal lobe; with two pairs of processes on the aedeagus ..... *panamensis*

- Basoventral process only barely enlarged at apex, without a mesal lobe; one pair of processes from aedeagus ..... *sedmani*
10. Venter of aedeagus with a pair of sclerotized, caliper-like lobes apically ..... *brevis*
- Venter of aedeagus without such a pair of caliper-like lobes ..... *angustior*

*Austrotinodes angustior* Schmid

*Austrotinodes angustior* Schmid, 1955:133; 1958:202.—Fischer, 1972:88.

This species is known only from the Provinces of Chiloe and Maule in Chile.

*Austrotinodes brevis* Schmid

*Austrotinodes brevis* Schmid, 1958:201.—Fischer, 1972:88.

This species was previously known only from the type from the Province of Arauco, Chile. It is now recorded from the Province of Malleco.

**Material:** Chile, Malleco, Rio Manzanares, 2 Jan. 1966, Flint & Cekalovic, 1 ♂.

*Austrotinodes cekalovici* Flint

*Austrotinodes cekalovici* Flint, 1969:507.

The type-material of this species came from the Provinces of Cautin and Valdivia in Chile.

***Austrotinodes irwini*, new species**

Figures 27–29

This Chilean species is closely related to *A. recta* Schmid, differing in details of the cerci and claspers. The mesal darkened area of the cerci is further basad in *irwini*, the basal processes of the cerci are quite different especially the curved mesal one, and the claspers differ in being angulate before the apical constriction and the apex itself is produced into a single erect point on each side.

**Adult:** Length of forewing, 7 mm. Color in alcohol, pale yellowish. Male genitalia: Ninth segment divided laterally, produced posteriorly ventrally, with posterolateral angle produced into a thin lobe. Tenth tergum a simple membranous lobe between bases of cerci. Cercus elongate, rounded apically, mesal face with a darkened expansion at near midlength; with two pairs of processes basoventrally, dorsolateral process elongate, simple, ventromesal process arising from a cuplike base, with apex gently upturned. Claspers fused mesally, very long, produced into a thin, upturned flange laterally, with a lateral subapical angle, apex produced into a darkened, erect, point on each side; with a basodorsal

arched rod. Aedeagus elongate, membranous apically with a pair of long, slender spines.

*Material:* Holotype, male: Chile, Prov. Malleco, Parque Nacional Nahuelbuta, 4350', 24 Jan. 1967, M. E. Irwin (UCR). Paratype: Same data, 1 ♂ (USNM).

*Austrotinodes latior* Schmid

*Austrotinodes latior* Schmid, 1955:132; 1958:200.—Flint, 1967:55.—Fischer, 1972:88.

The species has been recorded from the Provinces of Chiloe and Valdivia in Chile and is now recorded from Malleco, Concepcion, and Nuble.

*Material:* Chile, Malleco, Rio Manzanares, 2 Jan. 1966, Flint & Cekalovic, 1 ♂. Prov. Concepcion, Fundo Pinares, 30 Dec. 1965, Flint & Cekalovic, 3 ♂. Prov. Concepcion, Quebrada Honda, near Lirquen, 31 Dec. 1965, Flint & Cekalovic, 2 ♂; same, but 5 Feb. 1966, Cekalovic, 1 ♂. Prov. Nuble, Rio Pinto, east of Chillan, 24 Oct. 1969, Flint & Barria, 2 ♂.

*Austrotinodes lineatus* (Navas)

*Tinodes lineata* Navas, 1934:166.—Fischer, 1962:192.

*Austrotinodes lineatus* (Navas): Schmid, 1955:132.—Fischer, 1972:88.

This species is known only from the original description which is insufficient for identification of the species. No locality is given for the types, but presumably they came from Chile.

***Austrotinodes mexicanus*, new species**

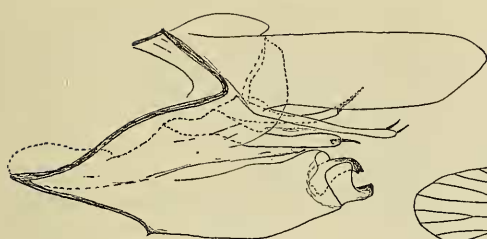
Figures 16–20

This species is closest to *A. sedmani*, new species, from which it is easily recognized by its bearing two pairs of processes from the aedeagus and by having the lateral lobe of the clasper clearly set off from the mesal portion.

*Adult:* Length of forewing, 4.5 mm. Specimens in alcohol; color now uniformly brownish. Male genitalia: Ninth segment deeply divided laterally with ventral portion prolonged posteriad. Tenth tergum consisting of a pair of elongate, membranous lobes lying dorsally between

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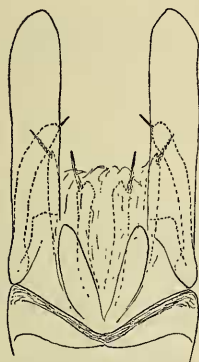
FIGS. 16–24. *Austrotinodes mexicanus*, new species: 16, male genitalia, lateral; 17, cerci, aedeagus, and ninth and tenth terga, dorsal; 18, ninth sternum and claspers, ventral; 19, wings; 20, female genitalia, ventral. *A. sedmani*, new species: 21, ninth sternum and claspers, ventral; 22, cerci, aedeagus, and ninth and tenth terga, dorsal; 23, male genitalia, lateral; 24, female eighth sternum, ventral.



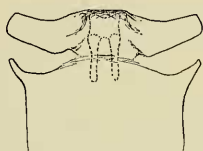
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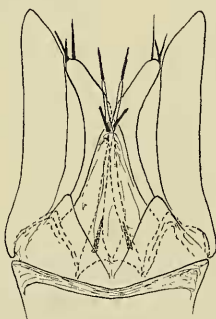
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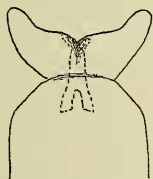
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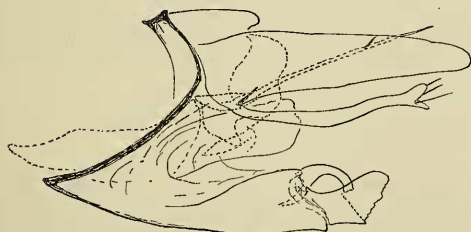
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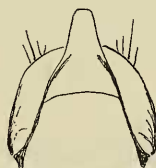
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the bases of cerci. Cercus elongate, parallel-sided, apex tapering to a blunt tip; with a long rodlike basomesal process bearing two enlarged apical setae. Claspers fused mesally, short with a thin basolateral lobe, posteromesally slightly produced and considerably darkened; with a basodorsal darkened rod, whose apex is slightly bilobate. Aedeagus with two pairs of slender, rodlike appendages, each bearing an enlarged apical seta. Female genitalia: Eighth segment with apodeme short; sternum prolonged posteriad and deeply and broadly divided mesally. Ninth segment with apodeme short; greatly prolonged and a narrow, compressed tube bearing scattered setae. Tenth segment elongate, narrow, with three pairs of apical papillae.

*Material:* Holotype, male: Mexico, San Luis Potosi, El Salto Falls, 23–24 June 1965, O.S. Flint, Jr. USNM Type 72478. Paratypes: Same, but 8 May 1964, Blanton, et al., 9 ♂, 3 ♀.

***Austrotinodes panamensis*, new species**

Figures 25–26

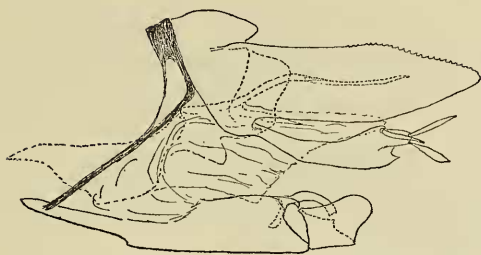
*A. panamensis*, new species and *A. sedmani*, new species are very closely related, appearing to differ only in the processes of the cerci and aedeagus. In *panamensis* the basomesal process of the cercus is broader apically and bears a distinct mesal lobe, and there is a distinct, although frequently obscured, basolateral spur on the aedeagus in addition to the long dorsal pair.

*Adult:* Length of forewing, 4.5 mm. Color identical to that of *sedmani*. Male genitalia: Ninth segment deeply divided laterally, ventral portion greatly prolonged posteriad. Tenth tergum consisting of a pair of broadly trianguloid membranous lobes dorsally between bases of cerci. Cercus elongate, tapering on apical third to a rounded apex; basomesal process expanded apicad, apex with a distinct ventromesal lobe, and three enlarged setae. Claspers fused mesally, short, with a thin rounded lateral lobe, posteromesally darkened and slightly divided; with a basodorsal arched rod ending in a blunt tip. Aedeagus with two pairs of slender dorsal processes, mesalmost very long with an enlarged seta at midlength, more laterad pair less than half length of mesal pair. Female genitalia: Apparently identical to that of *sedmani*.

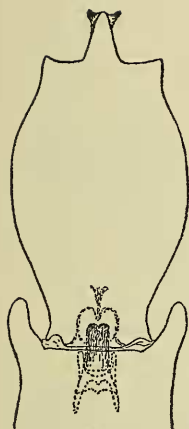
*Material:* Holotype, male: Panama, Cerro Campana, 11–14 July 1967, O. S. Flint, Jr. USNM Type 72479. Paratypes: Panama, Barro Colorado Island, 12 March 1967, M. E. Irwin, 3 ♂, 10 ♀ (UCR and USNM).

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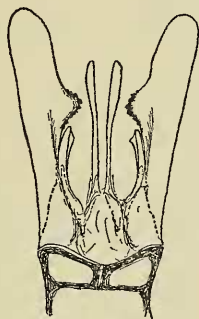
FIGS. 25–29. *Austrotinodes panamensis*, new species: 25, male genitalia, lateral; 26, cerci, aedeagus, and ninth and tenth terga, dorsal. *A. irwini*, new species: 27, ninth sternum and claspers, ventral; 28, cerci and ninth and tenth terga, dorsal; 29, male genitalia, lateral.



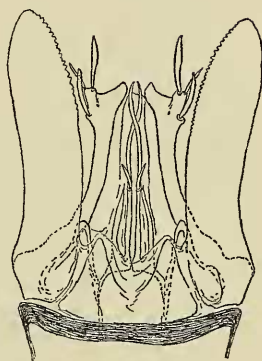
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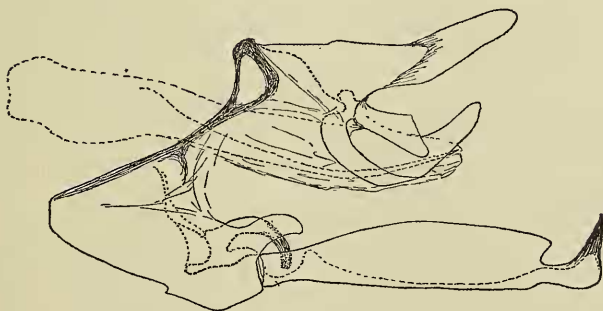
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*Austrotinodes quadrispina* Schmid

*Austrotinodes quadrispina* Schmid, 1958:200.—Fischer, 1972:88.

This species was described from a unique male collected in the Province of Arauco, Chile. I have examples taken in the adjacent provinces of Malleco and Concepcion.

*Material*: Chile, Malleco, Parque Nacional Contulmo, 2 Jan. 1966, Flint & Cekalovic, 1 ♂. Prov. Concepcion, Quebrada Honda, near Lirquen, 5 Feb. 1966, Cekalovic, 1 ♂.

*Austrotinodes recta* Schmid

*Austrotinodes recta* Schmid, 1964:322.

The types of the species came from the provinces of Malleco and Curico, Chile. I have taken it additionally in the provinces of Cautin and Llanquihue.

*Material*: Chile, Malleco, Rio Manzanares, 2 Jan. 1966, Flint & Cekalovic, 1 ♂. Prov. Cautin, Puente Huilquilco, 4 Jan. 1966, Flint & Cekalovic, 1 ♂. Cautin, near Pucon, 4 Jan. 1966, Flint & Cekalovic, 1 ♂, 2 ♀. Cautin, 30 km NE of Villarrica, 16–31 Dec. 1964, Pena, 1 ♀. Prov. Llanquihue, Rio Maullin, 6 Jan. 1966, Flint & Cekalovic, 3 ♂, 2 ♀. Llanquihue, Rio Gomez, 6 Jan. 1966, Flint & Cekalovic, 1 ♂.

***Austrotinodes sedmani*, new species**

Figures 21–24

The male genitalia of this species is very similar to that of *A. panamensis*, new species. *A. sedmani* is easily recognized by bearing only a single pair of processes from the aedeagus, and in the shape of the basomesal process of the cercus.

I take pleasure in dedicating this species to Dr. Yale Sedman who forwarded not only the paratype of this species from British Honduras, but also much other valuable material from this poorly known area.

*Adult*: Length of forewing, 4 mm. Head and thorax bearing whitish hairs, antenna cream colored, forewing mostly pale brownish with most of costal margin and a few small flecks elsewhere dark brown. Male genitalia: Ninth segment deeply divided laterally, ventral portion prolonged posteriad. Tenth tergum consisting of a pair of broadly trianguloid membranous lobes lying dorsally between bases of cerci. Cercus elongate, tapering regularly from base to rounded apex; with a long, rodlike, slightly sinuate basomesal process bearing several apical setae. Claspers fused mesally, short, with a thin, rounded lateral lobe, posteromesally darkened and slightly divided; with a basodorsal, arched rod ending in a blunt tip. Aedeagus with a pair of long slender lateral arms, each bearing several short, enlarged setae. Female genitalia: Similar to that of *A. mexicanus* except for eighth sternum which is entire and narrowly produced posteriad.

*Material:* Holotype, male: Guatemala, Izabal, Las Escobas, near Matias de Galvez, 26–27 June 1966, Flint & Ortiz. USNM Type 72480. Paratypes: Same, but 14–16 Aug. 1965, 1 ♀. British Honduras, Cayo Dist., Mountain Pine Ridge, 27 June 1971, G. Stacell, 1 ♂.

*Austrotinodes talcana* (Navas)

*Tinodes talcana* Navas, 1934:165.—Schmid, 1949:340.—Fischer, 1962: 203.

*Austrotinodes talcana* (Navas): Schmid, 1955:132.—Fischer, 1972:88.

The type, a female, came from the province of Talca, Chile. Schmid figured the genitalia of this specimen in 1949, but the species is still unidentified.

*Austrotinodes triangularis* Schmid

*Austrotinodes triangularis* Schmid, 1958:202.—Fischer, 1972:88.

The species is still known only from the types from the province of Arauco, Chile.

LITERATURE CITED

- BRUNDIN, L. 1966. Transantarctic relationships and their significance, as evidenced by the chironomid midges, with a monograph of the subfamily Podonominae, Aphrotaeninae and the austral Heptagiae. Kgl. Sv. Vetenskapskad. Handl. (4) 11:1–472.
- EDMUNDS, G. F., JR. 1972. Biogeography and Evolution of Ephemeroptera. Ann. Rev. Ent. 17:21–42.
- FISCHER, F. C. J. 1962. Polycentropodidae, Psychomyidae. Trichopt. Catalog. III:1–236.
- . 1972. Supplement to vol. III and IV. Trichopt. Catalog XIII:1–172.
- FLINT, O. S., JR. 1967. Studies of Neotropical caddis flies, II: Trichoptera collected by Prof. Dr. J. Illies in the Chilean Subregion. Beitr. Neotr. Fauna 5:45–68.
- . 1968. Bredin-Archbold-Smithsonian biological survey of Dominica. 9. The Trichoptera (caddisflies) of the Lesser Antilles. Proc. U.S. Nat. Mus. 125(3665):1–86.
- . 1969. Studies of Neotropical caddis flies, IX: New genera and species from the Chilean Subregion (Trichoptera). Proc. Ent. Soc. Wash. 71:497–514.
- ILLIES, J. 1965. Phylogeny and zoogeography of the Plecoptera. Ann. Rev. Ent. 10:117–140.
- KIMMINS, D. E. 1957. Notes on the Psychomyidae (Trichoptera) from the African mainland (south of the Mediterranean region), with particular reference to the genera *Ecnomus* and *Psychomyiellodes*. Trans. R. ent. Soc. Lond. 109:259–273.

- NAVAS, L. 1934. Insectos Suramericanos, novena serie. *Rev. Acad. Cienc. Madrid* 31:155-184.
- ROSS, H. H. 1944. The caddis flies, or Trichoptera, of Illinois. *Bull. Ill. Nat. Hist. Surv.* 23(1):1-326.
- SCHMID, F. 1949. Les Trichoptères de la collection Navas. *Eos* 25: 305-426.
- . 1955. Contribution à la connaissance des Trichoptères Neotropicaux. *Mem. Soc. Vaud. Sci. Nat.* 11:117-160.
- . 1958. Contribution à l'étude des Trichoptères Neotropicaux III. *Mitt. Zool. Mus. Berlin* 34:183-217.
- . 1964. Contribution à l'étude des Trichoptères Neotropicaux V. *Tijd. v. Entom.* 107:307-339.